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University of Nevada, Reno

Outta The Shell: The Automatic Boiled Egg Peeler

A thesis submitted in partial fulfillment of the
requirements for the degree of
Bachelor of Science in Mechanical Engineering and the Honors Program

by

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May, 2012

**UNIVERSITY
OF NEVADA
RENO**

THE HONORS PROGRAM

We recommended that the thesis
prepared under our supervision by

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entitled

Outta The Shell: The Automatic Boiled Egg Peeler

Be accepted in partial fulfillment of the
requirements for the degree of

BACHELOR OF SCIENCE

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Abstract

Health gurus are insisting that eggs are a nutritious food, providing many benefits. This food helps keep a balanced diet, aids in weight loss, and can be made into a variety of dishes. Unfortunately, peeling an egg, whether hard-boiled or soft-boiled, is tedious, messy, time consuming, and for those with limited use of their hands, difficult if not impossible. The Outta The Shell design team created a counter-top kitchen appliance to take care of this troublesome task. Such a device will encourage people to eat healthier and will give those who have been deprived the opportunity to prepare boiled eggs once again. After much research and testing, the final design works in a two phase system, one to cut the egg shell and on to pull the shell halves apart. The materials used will comply with set standards and codes as well as limit the product's impact on the environment.

Acknowledgements

I would like to give thanks to all the people who have helped make this project a success. My mentor and thesis advisor, Dr. Kam Leang, gave me and my group the push and strive to complete the project to our best abilities. When we were stuck with a troubling task or lost motivation, Dr. Leang was quick to spur inspiration. I would also like to thank my group members, because without their individual expertise and collaboration, this product would not have come through as well as it did. Sasan Alishahi, Greg Beasley, Jr., Mitch Bellamy, Matt Hoff, and Jeff Iddings each contributed to the egg-peeling success. The Honors Program and the Department of Mechanical Engineering together created a wonderful atmosphere to conduct research and expand my critical thinking. And finally, I could not finish my thesis without recognizing my parents for their continual love and support. Thank you, everyone, for helping me in my college endeavor.

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Introduction

As graduation approaches, my parents and I set up the lunch menu for all the guests said to come. We'll have vegetables and dip, barbequed chicken, leafy salads, and of course deviled eggs. When I insisted on included the latter, my mom's first reaction was, "Really? Do you realize how many hard-boiled eggs that would be?" With a sparkle in my eye and a cheesy half smile I reply, "No worries, ma. I've got Outta The Shell, The Automatic Boiled Egg Peeler!"

Eggs are a very popular item on the grocery list for many Americans. "Item penetration is approximately 93%, meaning eggs can be found in nearly every household" (United States American Egg Board). The hard-boiled egg can be eaten at any time of the day with many different dishes. The most popular time of day to consume hard-boiled eggs is in the morning, where a good deal of people are tired and looking for a quick, easy meal. The effort required to peel a hard-boiled egg can make for an arduous morning task, yet if people had a way to quickly and effectively peel the egg they might be more inclined to eat them. Even more, peeling an egg might seem a monotonous chore to some, but for the elderly and anyone with limited use of their hands, it is much more than that. Peeling the shell off an egg, especially with the tiny crumbles and sticky membrane, could potentially steer consumers from eating boiled eggs all together. It is truly unfortunate that the health benefits of the eggs are compromised simply because their preparation is strenuous and frustrating.

A hard-boiled egg peeler could also be convenient for restaurants and hotel buffets. Since the amount of eggs that need to be peeled in these establishments is much greater than that of a single household, the amount of time and effort spent is

proportionally greater as well. Whether it is a continental breakfast or buffet, hard-boiled eggs are a popular item for consumers. Since there is a high population of people eating at hotels and restaurants, there needs to be a large number of hard-boiled eggs to ensure the guests an opportunity to consume the healthy protein. The time spent to peel all the hard-boiled eggs is going to cost the company precious time and money. Instead of paying someone to peel all these eggs, that worker could spend their time completing other tasks as some mechanism peeled the eggs. The boiled egg peeler simply brings the consumer the health benefits of eggs in their diet with nearly no effort in the peeling process. Sanitation is also a major issue with many restaurants in the community. With the development of the automated egg cracker and peeler, the device will be easy to clean and employees will not have to fiddle with peeling eggs and contaminating other dishes in the kitchen. With proper care and cleaning of the machine, there will be less bacteria transfer from the human handling of these eggs and health hazards can be avoided.

The logic behind the hard-boiled egg peeler is essentially that it promotes a healthier, more efficient life-style. Health departments are insisting on an increase of eggs in the American diet. If people had access to a faster and nearly effortless method of peeling the hard-boiled egg, they would be much more motivated to eat one. Peeling hard-boiled egg shells can be very difficult and frustrating for many people as the risk of losing some of the egg in the process is likely, since it tends to stick to the shell. Another issue the peeler can resolve is the time crunch. A well-designed mechanism for peeling eggs could save the user precious time – after all, time is money. The greatest concern for egg consumption, however, is the difficulty elderly or disabled people encounter when attempting to peel an egg. The device will make a positive difference in their diet and

their happiness. There is no alternative to the quality of an egg and it is often described as “nature’s perfect food”; “eggs are a ubiquitous part of breakfast and provide the highest quality protein, versatility, and convenience” (United States American Egg Board). The hard-boiled egg peeler simply brings the consumer the health benefits of eggs in their diet with nearly no effort in the peeling process.

The purpose of this design, then, is to automate the process of cracking eggs – whether hard-boiled or soft-boiled. Between restaurants that use eggs extensively in their recipes and the average individual who eats eggs as part of their diet for a healthy lifestyle, the need for an autonomous egg cracker is quite simply convenience. After an overview of the requirements, the design team decided that this would be an enjoyable and appropriate project for us to take from idea to prototype by the April deadline.

Project Goals and Objectives

In the allotted time frame, the group planned to have a Proof of Concept by December followed by a working prototype by April. Meetings were held on a weekly basis in order to maintain communication and productivity, to experiment possibilities, and to actually build the prototype. Concurrent design was emphasized for this project. The design will require a great deal of research and testing. Aspects of the egg was heavily noted and accounted for, such as the thickness of the shell and the other layers of the egg, which each vary depending on the breed of the chicken. Also, there are generally six different egg sizes found in stores, each of which would be considered for the final product.

Specific objectives were set up to complete are research focused – the group aimed to know everything relevant about eggs. Each egg varies in size, shape, grade, and

shell thickness. Given this diversity, the final product should seamlessly adjust between the differences. Then, brainstorming and creativity were required to develop an idea for the actual device. This includes determining a durable, easy to clean blade that will not damage the eggs, a vacuum mechanism, a possible shell disposal mechanism, and a possible egg retrieval method. The next task was to determine any electrical components that would be needed as well as the necessary mechanical motors to automate egg cracking.

The challenges of the project were important to predict as early as possible. The electrical components may be difficult to adapt to. Though the goal is to make the egg peeling process quicker than if done by hand, the design will have to do just that. If not, it will need to modify the device to make it faster, which could be problematic at a late stage. Due to the differentiation of the various egg types and sizes, designing for this adaptability will prove challenging. There might also be a higher cost than anticipated if all ideas are not thoroughly planned. The whole team is going to analyze and approve each money transaction to prevent overspending. As far as the design, it may be difficult to acquire suitable components. Careful planning and design should avoid these obstacles.

Consumer Characteristics

If one concept were to describe Outta the Shell's goals for the egg project, customer satisfaction would just about wrap it up. The consumer population has a need – to de-shell a boiled egg – and this product should do just that. Simply put, if the consumer is not pleased with the initial characteristics of our product, they are not going to purchase it. Or if they do purchase it, they will be displeased with the functionality of

the product and will request a refund. Additionally, as an engineering team, Outta the Shell is focused on designing quality and functionality. Peeling hard-boiled eggs can be a difficult task for those who face set-backs because of youth and/or physical disabilities. More specifically, the following design characteristics are listed in order of importance to both Outta the Shell and the consumer.

The function and durability of the product is the most important aspect of this design. If the consumers are spending their hard-earned money on the product because they like the idea and could put the appliance to good use, they would prefer that the product not only accomplishes what it claims to accomplish, but that it does it in an efficient manner. The durability of this product is also very important. Generally, people shop for products that will last. The longer the appliance functions, the better the product's review and the greater the chance is that the consumer will want to purchase the product again when it does eventually quit. Outta the Shell ultimately wants the consumer to be glad that he or she purchased the egg peeler.

Another important aspect of the product would be the maintenance and how easily it can be achieved. The maintenance includes the actions that the consumer has to carry out in order to keep the product working properly, such as blade sharpening or replacing and basic cleaning. Designing our product to accomplish the main elements of cooking and peeling the egg is one thing, but to make the product consistent over a long period of time and use at little to no effort to the consumer is an entirely different goal to accomplish. It is, of course, desirable for the consumer to do as little maintenance as possible while also achieving the absolute best and consistent result. Outta the Shell wants the consumer to know that our product will in fact cook and peel eggs, though

some product care is required. The maintenance of this product is slightly less important than its functionality and durability, because a worthless, unreliable product will never be sold – even if Outta the Shell can promise close to no maintenance required. The consumer will sacrifice some time to maintain a perfectly working product in order to keep that product working perfectly.

From the point of view of the consumer, the cost of this product is a very important characteristic. Any smart-shopper will ask themselves before purchasing any product, “Is this worth the money for what it accomplishes?” We want the consumer to respond to this question with as much positive feedback as possible. If the product is far too expensive, consumers would not even consider the product. On the other hand, if the product is extremely cheap, the consumers might assume that the product is poorly made, perhaps even that it was designed merely with a quick profit in mind. There is a very small area that represents the perfect cost for a product that falls between the two judgments the consumer may make before the purchase of the product, and Outta the Shell plans on designing the product to fit into that portion. The cost of the product has a large effect on how many appliances we would sell. The cost is less important to Outta the Shell than the functionality and the maintenance of the product, because even if the cost is too high or too low to the consumer, they are still ultimately concerned that the egg peeler will work and last. Without those qualities, the cost no longer matters.

Powering the device also needs to be simple and cheap for the consumer. After figuring out a good cost and making sure the product will perform the task required by the consumer, there needs to be an efficient way of powering the device. Since the egg shells will be removed either by pressure or by cutting the shell itself without any effort

from the consumer, the product requires a power supply that will ensure the task is completed efficiently. Along with many other appliances that are used in the kitchen, a wall plug is assumed to be the best way to power the device. With this power source, there will be no need to purchase replacement batteries, thus contributing to the product's reliability and low cost.

Another characteristic that needs to be considered is the size and weight of the final product. It is important that the device can be easily stored and that it does not take up a large amount of counter and cabinet space because there are other kitchen appliances that may be used more frequently than Outta the Shell's egg peeler. The weight is also an important characteristic. If the device is used on a weekly basis rather than a daily basis, it needs to have a lightweight structure so that it is easy to move from one spot to another. The consumer is not going to want to purchase a device that just cooks and removes the shell of a hardboiled egg if it takes up too much space in the kitchen or is too hard to move, or in other words, if it is unnecessarily bulky. The size and weight of the product are not ranked too high in terms of importance because we believe the consumer would rather have a cheap device that works 100% of the time compared to a device that is small and light that cost more but yet does not work as well as it should.

The last characteristic that needs to be addressed is the appearance of the finished product. The aesthetics of the device ranks last in importance because we believe the consumer is mostly interested in the fact that the product will efficiently remove the shell of the hardboiled egg over the appearance of the product. Along with the functionality of the device, the characteristics that make the device easy to use with minimal effort from the consumer are also believed to be more important than the overall appearance. It is

essential, however, that the device looks professionally built. Appealing appliances tend to imply a sense of quality. People are probably not going to buy a product that look cheap and thrown together, appears to not work at all, or looks like an actual scam. The product also has to fit the appearance of most appliances that reside in the kitchen because that is the primary location the product will be placed. Since most appliances that are used in the kitchen already somewhat look alike in terms of appearance, the Outta the Shell egg peeler needs to be able to blend in with these other appliances easily. Consumers should be proud of their egg peeler, not ashamed.

As far as the other characteristics are concerned, the focus was designing a product that consumers will want and enjoy while also surpassing the competitors. The appliance should be simple to operate, easily maintained, and should be priced according to its worth and still less than other similar products. The egg peeler will utilize power supplied by a wall outlet, will be reasonably sized, and will look attractive as a home appliance. All of these qualities will together form a desired, marketable product.

Design Research

In order to build an efficient product, further analysis of the egg was needed to establish parameters for the team's egg de-shelling device. In the Study of the Physical Properties of the Hen's Eggshell in Relation to the function of Shell-Secretory Glands by Alexis L. Romanoff, a sample size of 3,998 eggs showed that the average maximum (breaking) strength and thickness of the shell are 4.46 kilograms and 0.311 millimeters respectively. The load was applied perpendicular to the egg's axis at the strongest point of the shell (Romanoff, 1929). Further analysis of the egg shell was performed by Ayman H. Amer Eissa and Abdul Rahman O. Alghannam in their paper, New Trends for

Understanding Stability of Biological Materials from Engineering Prospective, the following parameters were found: Young's modulus, $E = 3 \times 10^{10} \text{ Nm}^{-2}$, Poisson's ratio = 0.307 and the mass density = 2400 kgm^{-3} (Ayman and Alghannam, 2011).

Related and Existing Designs

The Outta the Shell boiled egg peeler is a fitting task, a task that according to the US Patent Office has been tackled since the 5th of April, 1913 ("Google Patents"). After conducting research and comparing products, this egg peeler will be unique, with only a few similarities, to those submitted to the US Patent office. The similar features to US Patent 1,097,283 and 4,149,456 will be the use of a cutting device to separate the shell from the egg ("docstoc.com"). The use of a spring style clamp associated with patent 4,149,456 raises interest in addition to the pumping apparatus, the Egg Extractor ("Hard Boiled Egg Peeler"), but will not be utilized in this particular design. Outta the Shell's boiled egg peeler has changed frequently throughout the design process, but the primary goal of the design remained the same, which as research shows has yet to be attempted. The design is to efficiently remove the shell of one or more eggs simultaneously and quicker than an elderly person, a person who struggles using their hands, or anyone who simply wants the convenience of an egg peeler could accomplish the same task. Outta the Shell will use mechanical assistants, such as a vacuum system, motors, and blades. It will also use electrical configurations to provide for the actual cutting and peeling processes.

Standards and Codes

Egg and Food Standards

It is very important, ethically, to comply with standards and codes in all sub-fields, including the health of the egg itself. We want the product to keep the egg as

sanitary as possible during the de-shelling process. The healthy aspect of consuming an egg must not be jeopardized by the use of this product. Due to recent FDA standards of eggs, the federal register proposed a regulation for preventing salmonella in eggs during production (“69 FR 56823”). This standard involves an analysis of the salmonella content in relation to the cleanliness of the livestock area and also any egg handling throughout the production process, which includes safe sterilization and refrigeration. As long as the design acknowledges this standard and adheres to its preventative measures, there will be no consequences to face in the future. So, in order to avoid salmonella, the egg peeling process will be quick, efficient, and residue-free, all of which will be designed into the product itself.

Another more recent standard from the Good Environmental Livestock Production Practices (GELPP) addresses the concentrated livestock operations and the production areas (ANSI GELPP 0002-2002). Focusing on the current livestock challenges both environmentally and industrially, it ensures better management practices to reduce environmental hazards in the hens’ living conditions. These better practices mean better, healthier eggs. Fortunately, this will enhance the consumers’ satisfaction and their continual desire for boiled eggs.

Materials

The egg shell is nature’s best defense against bacteria for the egg itself. The final product design will comply with strict material standards and recommended codes to further protect the food. Specifically, standards and codes that focus on touching the yoke or more albumen (white) of the hard-boiled egg are of great importance. The most common materials used in kitchen appliances, because of such standards, are aluminum,

stainless steel, and silicon rubber, and durable plastic. Therefore, the final egg de-shelling device will incorporate many of these in its components.

Silicon rubber will be used to seal off holes and gaps in the device. FDA approved silicon rubber according to CFR 177. 2600 meets the strictest requirements for applications where food and consumables are present. Rubber-Cal provides this FDA approved rubber meeting the CFR standard (Rubber-Cal). The classification for rubber is Subclass H - rigid or semi-rigid plastic containers with plastic aluminum, steel-based, or tin lids. Class A signifies food ware, cookware, and tableware. The FDA also provides a classification for the primary material used to make the product, known as process indicator codes (PIC). The PIC for this particular design falls underneath three PIC's, L, S, and U, which are Iron, Plastic or Polymer, and Stainless Steel, respectfully.

The design utilizes multiple materials but to the general consumer they are regularly seen. The shell of the design will be mostly hard plastic and stainless steel, seen in most kitchen appliances today. The blade used to cut through the egg shell will be stainless steel, and hoses will be silicon rubber. Utilizing these FDA standards and guidelines will ensure Outta the Shell has a product safe for consumers worldwide.

Machining

The codes and standards for machining specifications essentially help with determining what materials, processes, and methods to use especially when dealing with a food service item. A good example of this includes standards for food cutters, F1126-08, which deals with electric table or counter-top food cutters. Learning and using standardized terminology for describing food service equipment comes from standards such as F1827-97 Machining standards range from test preparations for performance to

general specifications. The importance of using standards pertaining to food service equipment is to ensure that the materials and processes used for the egg-cutting machine are food safe and will not contaminate the egg during and/or after the de-shelling process.

Electrical

Another group of standards that the design will implement will be the use of electricity and the requirements that need to be followed. Since the design will include an electrically powered machine, it is imperative to look into the standards that can ensure the design meets the same criteria as any other electrical appliance. First, the power used in the product must not exceed 250V, which is the most voltage allowed for a microwave oven ("Household and similar electrical appliances - Safety - Part 2-25: Particular requirements for microwave ovens, including combination microwave ovens"). Even though the product will be primarily used by customers within the home, this standard also explains the use by workers within the restaurant industry. The final product will not only be used for personal use, but by commercial use in many different restaurants and buffets as well. Since the device is smaller than a microwave oven, it must adhere to the safety requirements for small appliances ("IEC 60335-2-102 Ed. 1.1 b:2009 "). Other considerations include the product's heat generation and necessary heat safety measures. The standard previously mentioned also clarifies the meaning of a household item and the precautions that need to be accounted for when designing the product. Lastly, since Outta the Shell plans on creating a small business and implementing the product to the market and different food-supply chains, guidelines for successfully implementing the product into the market and the various safety requirements involved will also be incorporated ("ISO 22000 Food Safety Management Systems - A Checklist

for Small Business ").

Sustainability

Outta the Shell is dedicated to having the least impact on the environment as possible. It is important for engineers, companies, designers, homeowners, and all people of the Earth must do their best to ensure a healthy planet by reducing their carbon footprint wherever possible. Outta the Shell has evaluated the design of the egg deshelling device and has researched all potential solutions for reducing our carbon footprint. This research includes material analysis and energy efficiency, both of which make up the skeleton of the egg product.

Energy

Firstly, several components in the product will require electrical energy in order to operate. The egg peeler will use several motors to run the blade, the vacuum, and the various levers. There are options as to where the motors will obtain the necessary energy; therefore, Outta the Shell has chosen to use the most efficient methods available. To reduce the electric energy consumption from motors and their associated carbon footprints, various regulatory authorities in many countries have introduced and implemented legislation to encourage the manufacture and use of higher efficiency electric motors. A well-designed motor can convert over 90% of its input energy into useful power for decades. When the efficiency of a motor is raised by even a few percentage points, the savings, in kilowatt hours and by extension cost, are enormous. The electrical energy efficiency of a typical industrial induction motor can be improved by: 1) reducing the electrical losses by increasing the cross-sectional area of the conductor, improving the winding technique, and using materials with higher electrical

conductivities, such as copper; 2) reducing the electrical losses in the rotor coil or casting by using materials with higher electrical conductivities, such as copper; 3) reducing magnetic losses by using better quality magnetic steel; 4) improving the aerodynamics of motors to reduce mechanical windage losses; 5) improving bearings to reduce friction losses; and 6) minimizing manufacturing tolerances. Outta the Shell can purchase necessary motors with the NEMA Premium stamp to ensure optimum efficiency and less power consumption.

In order to reduce the amount of electricity used in the household, usually generated from limited resources, the device will use batteries. Furthermore, the batteries will be rechargeable so to reduce chemical and material waste. The major pollutant of batteries was mercury; when it became apparent several years ago that mercury was an environmental hazard, manufacturers began seeking ways to produce efficient batteries without it. Through many countries' governmental agencies requiring environmentally friendly devices and ingredients, today's alkaline batteries may contain approximately .025 percent mercury. The widespread use of batteries has created other environmental concerns, such as toxic metal pollution. Battery manufacturing consumes resources and often involves hazardous chemicals. Used batteries also contribute to electronic waste. Some areas now have battery recycling services available to recover some of the materials from used batteries. Recycling or proper disposal prevents dangerous elements such as lead, mercury, and cadmium found in some types of batteries from entering the environment helps with this problem. If the use of batteries is sufficient, Outta the Shell can provide rechargeable batteries and offer incentives for sending in used batteries to be properly disposed of via recycling.

Testing and Results

The final product design came about through no easy process. Much of the design was created by trial and error. When a plausible idea was put on the table, it was tested, modified, and tested again, and if it failed reluctantly, it was tossed into the pile of ideas. Of course failed ideas were never completely trashed, just put on the back burner. If any part of a concept worked it, regardless if the entire concept was a success, it could be incorporated into a future idea.

Evolution of Design

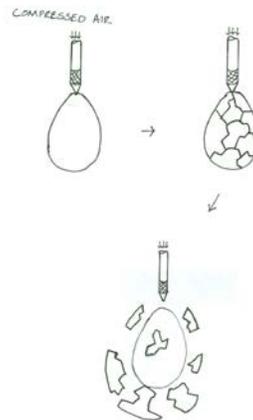
For cutting the egg, the problems are determining a quick and efficient way to de-shell multiple eggs at a time, having the same result for all egg types, and the actual method for de-shelling. Since there are different categories for eggs, this machine would need to move seamlessly between the various eggs and have the same result. As this project is intended to be a counter-top kitchen item, determining the number of eggs the machine can de-shell at one time is a significant task. The method of de-shelling is the main priority. This involves determining the best way to de-shell eggs that will not ruin the boiled egg to be retrieved and consumed by the customer or user. This also involves determining the method that will have no effect on the edibility of the egg and making sure that all parts can be easily broken down for cleaning.

After getting the egg properly cut, the next step is finding an efficient way of removing the shell, disposing the shell, and retrieving the finished egg product. Ideally, the cut will be made around the middle of the egg leaving two shells that need to be removed. The main problem is removing both shells at the same time. It is not

challenging to think of ways to remove one of the shells, but after removing one shell it is difficult thinking of an efficient way of removing the other shell.

Outta the Shell has gone through several designs throughout the research, brainstorming, and testing processes. Some ideas incorporated mechanical machines such as clamps and wheels, while other ideas were more *out of the box*.

There are three general methods that Outta the Shell has in development to remove the shell from the egg. The first method is the clamp method, which pulls the shell halves off. This will utilize spring-loaded claws with springs calibrated to be gentle enough not further crack the egg shell yet just firm enough to hold the egg in place. When the lid is opened, the clamps on both ends will reveal the hard-boiled egg and allow it to come out. The second method is the rubber-suction method, which involves suctioning cups to both sides of the egg. When the eggs are held by the rubber cups and the lid is opened, the suction will continue to hold the shells and will free the eggs. The last possible method is to take advantage of the air pocket inside the egg. By pushing in even more air into the pocket, the shell will separate from the egg. This process is seen in figure 1. This is similar to the methods hunters use to skin their animals. Unfortunately, the shell of the egg proved too durable for the air to break it apart. The air ended up breaking through the other end of the egg through a tiny hole the pressure created. With an increase of pressure, the actual boiled egg exploded with the shell. For any of the possible methods, most of the components used in the product will be dishwasher safe or easily cleaned in the sink. The shells can be disposed of into the trash or compost.



● SHELL SEPARATION USING INTERNAL PRESSURE NTS ①

Fig. 1. The process of removing the shell through air pressure. The stages are: (1) upper left, the air compressor is attached to the egg; (2) upper right, the air is pushed into the gap between the egg and the shell through a small hole and the egg begins to crack; and (3) bottom, the shell pieces break away from the egg.

As far as cutting the egg shell, there were also several ideas to test and consider. One involved hot wire as seen in figure 2, which would burn through the shell creating a perfect split along the smaller circumference. The egg shell is much too heat resistant for that to work, however, so that idea was not developed further. The next idea was modeled after an apple peeler, where a crank rotates an apple so that a blade peels off the skin and the screw mechanism pushes the apple along until completely skinned. The egg peeler worked in a similar fashion except the screw system was removed to keep the egg stationary. This idea proved to be the standing prototype halfway through the design process. A sketch of the design is seen in figure 3. During the second half of the design process, the prototype was simply modified so that a motorized wheel rotated the egg instead of a person. The design was first tested with an egg lying along its long horizontal axis, as seen in figure 4. This was an unstable set-up as the pressure of the egg against the

wheel and the egg against the blade was much too variable. Then the final idea came about – a vertically standing egg, rotating with the aid of a wheel, and cut along its smaller circumference.

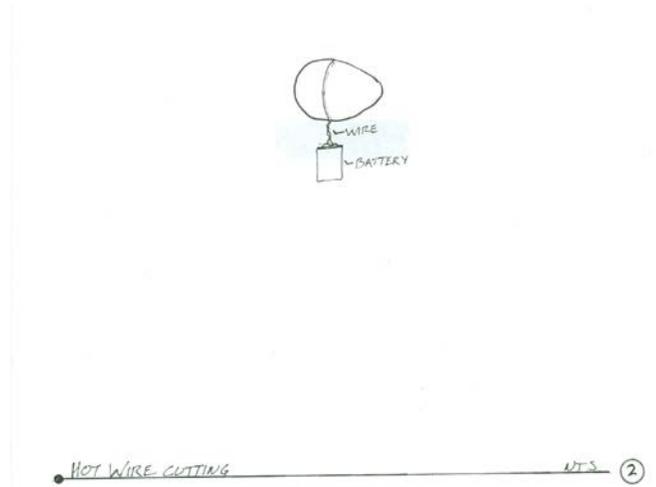


Fig. 2. The proposed hot wire method with a wire wrapped around the egg and attached to a battery at its ends.

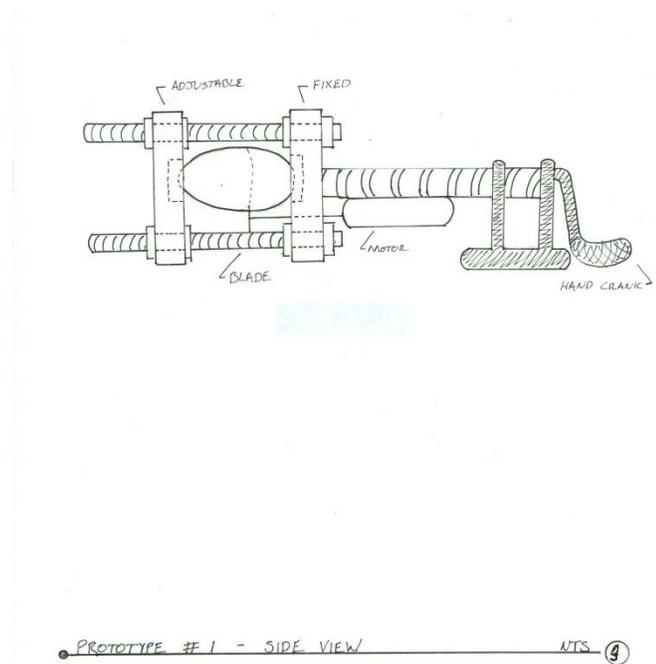


Fig. 3. The first prototype which incorporated an apple peeler.

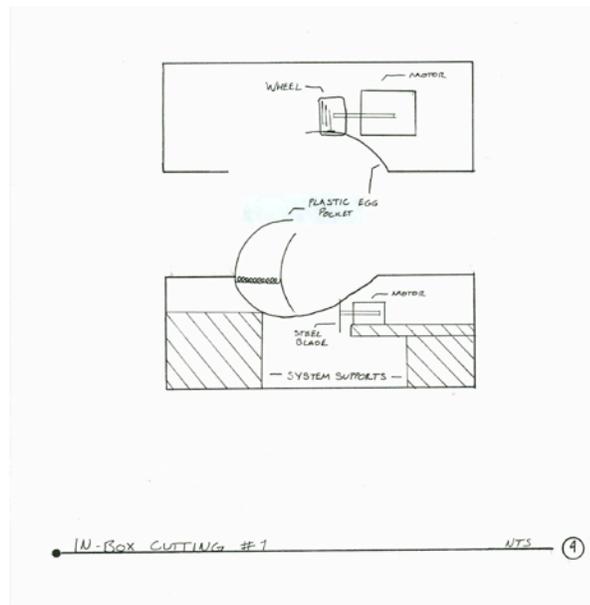


Fig. 4. The first prototype modified into a hands free design, with a motorized wheel replacing the hand-crank.

Prototype and Final Product

Current Prototype

There are many factors of the product that provoke safety concerns. Outta the Shell will develop a device that incorporates a spinning blade, vacuums, and electricity. One of the main concerns is to have the blade quit spinning when the dome is opened to avoid any human contact with the spinning blade. The group will do this by hiding the blade such that it is unlikely a user will come in contact with it. There are many mechanical, thermal, and structural elements of the product so the team will need to consider appropriate materials that will allow the egg peeler to function and last. Many kitchen appliances use stainless steel and hardened ABS plastics that are easily cleaned, won't oxidize, and will be tough enough to withstand common kitchen environments. The main housing of the product will be stainless steel or aluminum for its durable properties. A plastic will be used for the lid that is able to withstand vibration or rough

use. There will also be a light indicating the device is on and hot to the touch. Inside the device, the blades will have to be stainless steel. The holders for the eggs are a smoothed plastic material that will not break down under functioning conditions and are easily cleaned. They will also help in gripping the egg as the shell is pulled off and will keep the eggs in place. All handles and levers will be either plastic or stainless steel and will be able to meet the strength requirements all while keeping cost down for our target price point.

The prototype presented in May peels an egg through a two phase process. The phases themselves were separated into two separate machines. The first phase was the cutting phase. Here, an egg is placed into the egg-shaped hole in the bottom box and the upper box is lowered onto the egg. Two motors turn on, using switches for the user to press, and the egg spins (due to the bottom half of the machine) while the blade cuts (due to the upper half of the machine). After a few seconds, the motors can be turned off and the upper box lifted. The egg shell is now cut. Figure 5 shows a SolidWorks drawing of phase one of the device developed.

In order to cut the shell without damaging the cooked egg inside, a high RPM spinning blade is necessary. Anything else would crush the shell and render any attempt to mechanically remove the shell virtually impossible. Figure 6 is a picture of the blade set-up used. To get a good cut around the diameter of the egg shell, a high torque rotation was required to counteract the friction from the high RPM of the spinning blade. Figure 7 is a SolidWorks drawing of the gears combined to create such a torque. All failures resulted in the egg not rotating and the motor burning out. Finally, a set of gears were

used to produce just the right amount of torque for the given speed from the motor in order to properly spin the egg.

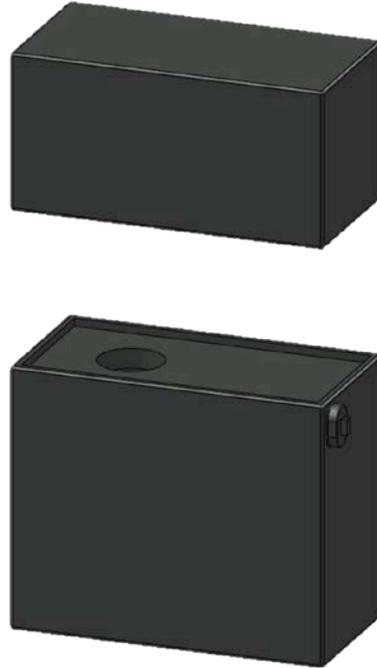


Fig. 5. Isometric view of the cutting devise for phase one. The upper box contains the blade and the lower box contains the gears and the wheel to spin the egg.



Fig. 6. A view inside the upper box in phase one. This is a close-up of the blade-motor system and the plastic shell to hold the egg in place.



Fig. 7. Isometric SolidWorks drawing of the gear system inside the bottom box in phase one. The far left gear is attached to the wheel and the far right gear is attached to the motor.

Phase two is the removal phase, as seen in figure 8. There are again two boxes with an egg-shaped hole for the boiled egg. Once cut, the egg is placed into the bottom box and the upper box is lowered onto the egg. The switches turn on the vacuum system, as in figure 9 hidden in the lower box, and the holes, which are actually cups attached to the vacuums, grip onto the egg shell halves. When the upper box is lifted, it takes the shell half with it, leaving a ready-to-eat boiled egg.

To separate the egg shell halves and inner membrane from the cooked egg inside, two vacuum pumps provided the most convenient method to incorporate. These vacuums needed to be strong enough to hold and separate the shell halves from the cooked egg but not overpowering.



Fig. 8. Isometric drawing in SolidWorks of phase two, the removal phase.



Fig. 9. A picture of the vacuum compartment and the switch set-up in the lower box of phase two as seen in figure 4.

Final Product

The final product, the product to be sold to customers, will combine phase one and two into one convenient, compact box. It will be fully automated so that the user will not have to lower or lift boxes, also adding to the overall easiness and convenience. The electrical components will be integrated into a circuit for smaller power consumption. And finally, the reduction in size will allow for portability.

One of the goals of the project was to design a mechanism that is practically effortless for the consumer, peeling a wide variety of eggs accurately and precisely. An outstanding goal the group hopes to achieve would be to adjust to the different egg sizes, grades, shapes, and shell thicknesses.

Business Proposal

As part of the design process, the design team wrote a business plan for what it would take if the group decided to continue with the idea past graduation. The complete business proposal can be found in Appendix A. The team has decided against marketing

the final product, but the process in which one would do so was duly noted. The process of writing such a proposal and planning for large-scale design can be applied to future designs or whatever each member comes across in his or her career.

Conclusions

Outta the Shell: The Automated Boiled Egg Peeler is dedicated to ease the process of peeling a hard-boiled or soft-boiled egg while increasing the health of society due to larger consumption of the natural and healthy protein within the egg. Therefore, the product must be as efficient and as customer friendly as possible. The egg peeler will include the following components: the appliance base, the egg stand, the electrical/power system, the motors, the suction mechanism, the roller, and the blade. The egg peeling process will be conducted through two phases: the cutting phase, phase one; and the removal phase, phase two. Phase one will be to place the egg into the holder for a mounted blade to cut around the small circumference of the egg, cutting only through the shell without penetrating the egg-white. The holder will rotate the egg while the blade cuts shell. Phase 2 will use two vacuum pumps attached at either end of the egg to pull the shell halves away from the hard-boiled egg. One vacuum pump will hold the bottom half of the egg shell in place while the top half of the egg shell will be removed with the top portion of the mechanism being lifted from the egg.

The hard-boiled egg will be left with no damage and no harmful residue, as the blade will be made of FDA approved stainless steel and will be sensitive to the egg's dimensions. The design team has successfully developed a prototype of this manner. Additionally, a Business Plan was produced to outline the product design, the market, and the financial aspects corresponding to next few years of the product's life if such a

product were to continue past the design process and enter into retail. Finally, the final prototype was presented in a professional design symposium with the product and all its attributes on display.

The egg peeler provides a convenient way for the youth and/or people with disabilities to remove the shell from a hard-boiled egg. This is also a method of pure convenience for those who prefer not to peel by hand. It is a simple counter-top appliance. For the customers' convenience, it is fast, mostly hands free, and welcomes all soft-boiled and hard-boiled eggs.

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adv.htm&r=37&f=G&l=50&d=PTXT&S1=("egg" AND peeler)&OS="egg"
AND peeler&RS=("egg" AND peeler)>.

*Appendix***Business Plan**

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II. Executive Summary

Outta the Shell focuses on the design and creation of a hard-boiled egg shell remover mechanism. Upon thorough experimentation and testing, we have reached a working design for this mechanism that flawlessly and effortlessly removes the shell of a hard-boiled egg in a completely safe manner. It is expected for the prototype of this design to be slightly different than the product that enters the market due to manufacturing capabilities and regulations, but the ultimate goal of Outta the Shell is customer satisfaction no matter what.

Our customers will be the number one priority at Outta the Shell. These customers could be restaurant owners that would like an easier more efficient method of peeling hard-boiled eggs, an operator of a buffet or salad bar that serves peeled hard-boiled eggs, or even the casual homeowner that enjoys eating hard-boiled eggs but struggles with the ability to effectively peel them. The sky is the limit on what Outta the Shell could become in terms of the customer. As long as our product flawlessly works throughout the course of its lifetime and is within a competitive price range for the buyers to consider it valuable, Outta the Shell will be an extremely happy and successful company.

Outta the Shell sees a very bright future for its product. The research we conducted has shown egg distribution, consumption, and retail sales are currently at their all-time high values. Other companies have responded to the demand for more eggs and attempted to solve the problem of the difficulty of peeling a hard-boiled egg, but have not been functionally successful. Outta the Shell has a better method to be incorporated in the egg consumption market. We, the owners, predict the product to actually increase the demand for more eggs upon the purchase of the egg peeler from Outta the Shell if it is exposed to the market properly and professionally.

In order for the product to enter the market properly, it will take some finances. The desired amount of finances through loans, sponsors, and investors is \$100,000. These finances will mainly be directed to the professional preparation of the product. This includes the formation of a website for the product, creating professional and thorough manuals and documentation for the correct operation and construction of the product, and professional and proper packing of the product in correspondence to a dependable and quick shipping company. Warranties will be established for the product in order to ensure customer satisfaction. Legal and financial protection will also be established to prevent Outta the shell from lawsuits.

Once complete customer satisfaction from the product as well as loyalty of service to them from warranties is achieved, this product will begin to spread like a wildfire and we will easily be able to pay back our loans due to selling the product as well as investing the excess money back in the company to help it grow. The consumer will analyze Outta the Shell and understand that they have nothing to lose by buying the product, because they want a simple and effective way to peel hard-boiled eggs. The product will work perfectly, and for any reason whatsoever that it will not work; the warranty is ensuring

that Outta the Shell will not rest until that customer is satisfied. A customer that likes the idea of the design and has nothing to lose with their purchase will have no reason not to buy Outta the Shell.

III. General Company Description

Outta the Shell is a design and production type of company. Great emphasis is placed on the perfection of the design of the egg peeler as well as contacting a manufacturer to create a prototype device. The company will follow the steps of production to get our one main product out in the restaurant market and on the shelves of various stores. Once Outta the Shell has overcome a reasonable portion of the market from the purchase of consumers, we will seek buyers of our intellectual property of the design to overtake the company as a benefit to both parties.

Mission Statement: To ease the process of peeling a hard-boiled egg while increasing the health of society due to larger consumption of the natural and healthy protein within the egg.

The main goals of Outta the Shell is to ultimately have a completely successful, working, and attractive final product that will flawlessly peel eggs. Upon accomplishing the previously stated goal, Outta the Shell intends to sell the design to a well-established and well developed company that can expand the horizons on the design upon their own request.

The objectives Outta the Shell must first accomplish before achieving its' goals are quite elaborate. First, a completely flawless and working prototype must be manufactured or constructed with as much detail as possible. Then, Outta the Shell will use this prototype for demonstrations for find potential sponsors for funding of the product if there is a benefit in the long term agreement for themselves, which Outta the Shell must compensate for. If finding sponsors does not produce the finances that are required for Outta the Shell, the team is prepared to find other funding from bank or small business loans to ultimately ignite the company. Next, Outta the Shell must use those funding resources and obtain an intellectual property patent on the design of the egg peeler. Finally, Outta the Shell will begin a search for a company that is interested in buying the patent protected design at a beneficial cost to both the design team and the company. A contract will be created and signed in the process of establishing this business partner.

The business philosophy is the basis of the governing laws of operation for Outta the Shell. We will represent and incorporate superior honesty, integrity, safety, and efficiency into the company to ensure our customers that we are a state-of-the-art company that will provide the very best. It is very important to us to consistently display these business philosophy characteristics to avoid any representation of instability within Outta the Shell.

The egg peeling product from Outta the Shell is for anyone who wants to save time as well as the hassle of peeling an egg by hand. Restaurants that serve dishes containing hard-boiled eggs would be interested in this product. A buffet that serves hard-boiled eggs for salad-bars, or simply as a side dish, would also be interested in this product. People who are very active and healthy will want to buy this product for the natural

healthy protein within eggs as well as Outta the Shells' time saving method of the egg shell removal. Generally, the product will be marketed towards any person or company who struggles with peeling hard-boiled eggs and desires an easier method.

The industry related to the egg peeling product from Outta the Shell is mainly the production of sales of eggs. This is in direct relation to the current consumption of eggs, egg production, and egg distribution. The egg distribution and production is currently at all-time high as well as very high egg consumption per capita over the past five years and is growing. Outta the Shell plans to take advantage of this craze for eggs by putting the egg shell peeling product on the market as soon as possible to satisfy the consumers. Further elaboration of the egg industry is described in the economics portion of the market section (section IV) of the business plan. Changes in the supply and demand of the egg industry are considered a possibility, whether it is for the better or the worse. If we provide a working product for the consumers, we would hope to see the demand for more and more eggs in terms of consumption and production continue to increase, hopefully in response to the use of Outta the Shell's egg peeler.

The success of Outta the Shell is considered to be directly related to the strengths and motivation of its owners. All of our owners have thorough knowledge and education of mechanical engineering, which gives Outta the Shell a large advantage in understanding the mechanical systems of the product as well as the manufacturing process for the product. We are all very interested in being fit a healthy, which gives us an advantage, because we would never want a product that will not be beneficial to the consumer in any aspect, especially personal health. Computer drafting and product design as well as simulation through software is also a big advantage for Outta the Shell to be able to make design changes efficiently, quickly and at no cost. Our various owners have also worked in the food industry, worked as salesmen, have industrial shipping experience, and have networking and market connections which all give Outta the Shell superior advantages as well as a broad spectrum of the environment for the lifetime of our product.

Outta the Shell is a partnership company. All of the owners of Outta the Shell trust one another to the extent of avoiding the extra work of filing the legal paperwork that is incorporated with a limited liability corporation (LLC). Outta the Shell owners intend to share the work load as well as any benefits that come of the company in a fair and equal manner.

IV. Products and Services

The description of the product is a device that effectively cuts and de-shells a hard-boiled egg. The design of the product will hold a hard-boiled egg in an encapsulated device to be rotated and cut in such a way as to not damage the hard-boiled egg. The encapsulation will then open in such a way as to remove the shell from the hard-boiled egg after cutting. The hard-boiled egg will then fall into a designated compartment for retrieving the egg while the shell remains in the encapsulation for easy clean up.

The factors that give Outta the Shell a competitive advantage over competitors are quality and reliability. The quality of the design of Outta the Shell will ensure that the accuracy of cutting and de-shelling a hard-boiled egg is better than what any similar product offers, therefore making a very reliable product for the user.

Pricing for the Outta the Shell product will be 30 US dollars plus additional charges for shipping. Shipping will be based off contract prices set up with either UPS or FedEx.

V. Marketing Plan

Economics

The size of our market can be determined by examining the amount of people that buy eggs along with the amount of restaurants or buffets that use eggs as a part of their menu. As seen from Figure 1A, the amount of eggs purchased by Americans is extremely high. Even though Outta the Shell's product deals only with hard-boiled eggs, the more eggs in households gives us a better chance at realizing the demand for our product. Figure 2A also backs up this argument because it shows the amount of eggs produced throughout the past couple of years. It shows that there is a high production rate of eggs being produced with no sign of a decline.

Another part of the market we will be examining is the amount of restaurants and buffets that use hard-boiled eggs in their menus. This part of the market has a higher demand for our product because they make a larger number of eggs compared to the average household. Figure 3A shows the number of eggs sold through three different types of restaurants, quick service, midscale, and casual dining. It also shows the amount of eggs that are used at different meals throughout the day. It shows that almost 100 eggs are used in one day. Even though breakfast mostly consists of cooked eggs, the rest of the day uses hard-boiled eggs in salads.

To finish up the total size of our market, Outta the Shell has considered many different types of customers that primarily eat hard-boiled eggs. Dominating this part of the market would have to be people who eat healthy and are trying to lose weight as well as people that choose to exercise and keep a clean, healthy body. We determined that these people eat more hard-boiled eggs more than the average American. Since hard-boiled eggs are such a healthy snack and morning meal, this part of the market can prove to have a large desire for our product.

Our product is also a somewhat original design. Since there are only about two products on the market right now that perform the task that our product performs, there are not many options that people have when choosing a product that de-shells hard-boiled eggs. Outta the Shell plans to design our product to outperform our competitors. Since this will enable us to have the best product option to perform the task of de-shelling a hard-boiled egg, we hope to have a dominate share in the market that's exceeds 60%.

Outta the Shell also estimates that out of all the people in America, around 15% eat hard-boiled eggs. This estimation is not including the amount of restaurants that use hard-boiled eggs in their menus. We believe that most of these customers would have a demand for our product knowing the difficulty of peeling the shell off a hard-boiled egg. Depending on the money situation and amount of hard-boiled eggs eaten by these customers will determine just how much of the 15% will truly buy our product.

Outta the Shell also estimates that since there is such a high rate of Americans who eat unhealthy, there will be a growing number of people that will start to eat hard-boiled eggs in order to become healthier people. Almost all of these people will have a slight demand in our product.

There are also many different barriers that we will be faced with when entering the market. The first will be the cost it takes to manufacture our product. Since Outta the Shell will not have a lot of money to begin with, we will need to find a different place to finance the cost to manufacture our product. Manufacturing is not cheap so we will have to start at a negative profit in order to sell our product. Consumer acceptance and brand recognition is also going to be a barrier that we will have to get past to become a successful company. Since we are essentially going to create our own brand of products that no one has ever heard of, it will be difficult to get our name out and have people recognize the effectiveness of our product. Another barrier that we will have to break through is fact that we do not have a lot of money for advertising. Since this is the best way for people to hear about our product, Outta the Shell needs to make sure that it will be successful before finding the money to make it happen. The last barrier we have discussed is the role that shipping costs will play in our profit. Outta the Shell determined that if we are not going to have specific locations where people can pick up our product in stores then we will need to ship them to the desired customers.

Outta the Shell decided on many different circumstances that we will need to plan out in order to avoid these barriers ruining our business. We will try to spend the least amount of money as possible when getting past these barriers, so when our product finally hits the market we will soon have a positive profit. One of the main goals is to start off small then sell the company to a successful business so they can deal with the advertising and manufacturing costs. This will also help the consumers recognize the brand so they will not be tentative when purchasing our product. At first the shipping cost will be difficult to overcome, but since we will be reaching out to people around our location of work we hope this will deflate the cost to ship products as well as decrease the cost to advertise the product.

Various changes in technology, government regulations, and the economy that could also have an effect on our company's success. If technology advanced and figured out a better solution to cutting the shell on the eggs that was better than the blades that we used could help the effectiveness of our product. However, with the advancement in technology our competition could also benefit from the change. Since Outta the Shell's product has to pass the safety regulations defined by the government, if it were to change our company could have a problem in designing our product to be safer for the customer to use. The economy also could determine how much money Americans have to spend on products like ours that are helpful but not needed. In a bad economy it will be difficult for us to sell our product because people could decide they can live without it and just use their hands to peel the shell off the egg.

Product

Key features of Outta the shell are that it is a fast product, an efficient product, an easily cleaned product, and a safe product. With Outta the Shell being fast, the user can justify the purchase of an egg de-sheller. An efficient product also helps with giving the user more incentive to buy the Outta the Shell product; compared to other similar products on the market that claim to effectively give a hard-boiled egg, Outta the Shell was designed to be accurate in cutting and de-shelling a hard-boiled egg. Having Outta the Shell be easily cleaned and safe is both for convenience and general safety for the user. An item that can be cleaned easily also helps with making Outta the Shell a viable buying product.

The most efficient device on the market guaranteed to leave a full, undamaged hard-boiled egg every time. Nearly no mess compared to the small pieces when peeling an egg by hand. Since eggs are an important part of a healthy diet, Outta the Shell helps with keeping up with healthy eating lifestyles. Compared to the Amazing Eggstractor, the user is not restricted to cooking the egg a specific way or subject to following a multitude of steps to use the product. Outta the Shell will effectively cut and de-shell a hard or soft-boiled egg. All in all, the main benefit of have Outta the Shell is the convenience of not having to hand peel a hard-boiled egg.

After sale services include warranties, technical support, frequently asked questions section on website, detailed returned policies. Warranties are for only defects in the product, not for misuse. This includes damaging from shipping or any damage not caused by the user. Technical support includes helping the users set up and instruction of safe use of the product. Return policies are also detailed.

Customers

Outta the Shell plans to sell their company to a business that will be able to mass produce the product as their own. The businesses that we believe will have an interest in our product can range from a couple restaurants equipment manufacturers to businesses that sell a variety of kitchen appliances. Even though we plan to sell the company, Outta the Shell will also look into the different kinds of customers that would have an interest in our product and use these statistics to convince businesses that this product can have a success in the market.

The first business that we will focus on selling our company will belong to the businesses that manufacture kitchen appliances. Outta the Shell wants to focus on companies that do not just sell one kitchen appliance, but sell many different types of appliances. FrigidAire Kitchen Appliances, GE Appliances, and Whirlpool are a few companies that our product might show interest in our product due to the fact that they sell many different kitchen appliances that range from refrigerators to microwaves. Even though our product is much smaller than their usual products, it is still a product that is used in the kitchen and can give them an advantage toward their directed market. Outta the Shell also feels that the size of their industry will be an advantage and will help

advertise the product to different businesses that sell these various items like Wal-Mart and Target. The location of the firm will not have an effect on our negotiations because they will be primarily through phone calls and emails, yet we will plan on trying to obtain a presentation in front of the desired business to really try and sell our product. It would be very helpful if the desired business had a location near Nevada.

Restaurants and buffets are the next businesses that we feel will have an interest in our product. Outta the Shell's product will allow these businesses to save time when dealing with hard-boiled eggs and time is money. Since these companies have to make a large amount of hard-boiled eggs throughout the day, our product will give them an advantage that will cut down the amount of time it takes to make this delicious snack. Ideally we would like to sell our product to restaurants that had a chain of businesses with different locations around the world because they would have a higher demand and need more products manufactured. We will also focus on different casinos around Reno. Since there are many different restaurants and buffets within casinos, they will have a higher interest because our product could be used at all restaurants that exist in the casinos. Location will be a key factor when selling our company. We will mainly focus on restaurants that are near the Reno area because we will be able to contact them easier and have frequent visits to maintain interest within the desired businesses.

Even though Outta the Shell plans to sell the company, we will also look into different customers that might be interested in purchasing our product. If we can establish a successful company that is able to sell our product to many different people, it will help negotiations with businesses to express the importance and success of the company. When selling the product Outta the Shell plans to target either male or females in the age group of 20-70 because these people would have a need and desire for our product. We feel that customers younger than 20 will not have the money to need the product and would rather just peel the shell with their hands if it saves them money. The customers will also reside in the upper Middle-class because they would seem to not care about the paying the price for the product as long as it saves them time and work to peel the shell. Outta the Shell will also focus on customers who are health nuts. These people probably eat more hard-boiled eggs than anyone else because they are very healthy and contain an excellent amount of protein. We also plan to be able to ship to across the United States in order to reach each customer that is interested in our product; therefore, the location of these customers will not be a disadvantage for our company allowing anybody to get their hands on our product.

Competition

The main products and companies that will be a threat to our business are various businesses that have products that are designed to peel the shell off a hard-boiled egg. Since our product is meant for eggs that are already hard-boiled, the main competition will be with products that achieve the same goal as ours which is to remove the shell without the consumer having to peel it at all. However, there are also products

that produce a shell-less hard-boiled egg without peeling it.

Major competitors:

- Eggies
(https://www.geteggiestv.com/?tag=im|sm|go|tm&a_aid=011&a_bid=532e311e&chan=G&data1=TM)
- Eggstractor (<http://www.eggstractor.net/>)

These businesses will compete with us because they have similar products, which will also cause a competition for customers. Outta the Shell will compete with the Eggies for customers more than the actual product. Even though both products have the same end goal of giving the customer a de-shelled hard-boiled egg, our product peels the shell while the Eggies product allows the customer to crack the egg into a plastic shell and boil these plastic shells. In the end the Eggies product gives the customer a de-shelled hard-boiled egg within the plastic shells. One of our main goals is to produce a product that removes the shell off a hard-boiled egg faster and more efficient, so if this is done we hope to steal the customers who bought the Eggies product and were disappointed with the result. The Eggstractor, on the other hand, is a product that essentially performs the same task as ours. Since it also takes a finished hard-boiled egg and uses their product to peel the shell off, Outta the Shell needs to make sure our product is better in order to compete in the market. Some of the goals are to de-shell the egg faster and more efficient to ensure that the customers will choose to use our product over theirs. Location will have no effect dealing with our competition because each of us are trying to sell our product to customers across the United States.

Since our product performs a very distinct task, there are no other indirect competitors that we will need to compete with.

The main reason Outta the Shell's product will differ from its competitors will be the technique we use to peel the egg shell off the hard-boiled egg. Eggies uses a technique that removes the shell from the egg before it is hard-boiled allowing the consumer to not have to deal with the egg shell at all. The Eggstractor removes the shell of a hard-boiled egg by making the customer poke a hole at the bottom of the egg and start the peeling process themselves. Next they use a pressure technique to remove the rest of the shell from the hard-boiled egg. Our product, on the other hand, will only require the customer to take the hard-boiled egg and place it in the mechanism, after that the product will cut the egg in half and remove both sides of the shell and give the customer a de-shelled hard-boiled egg in the end.

Table 1: Competitive Analysis

FACTOR	Me	Strength	Weakness	Competitor A	Competitor B	Importance to Customer
Products	1	X		3	2	4
Price	3		X	1	2	1
Quality	1	X		3	2	1.5
Selection	3			3	3	5
Reliability	1	X		3	2	1
Stability	1	X		2	3	2
Expertise	2	X		3	1	
Company Reputation	2		X	1	3	5
Appearance	2		X	1	3	5
Sales Method	3		X	1	2	2
Credit Policies			X			5
Advertising	3		X	1	2	3

There are many advantages and disadvantages that reside in our product compared to its competition. Our main advantage is that it will perform the task of removing the shell faster and more effective compared to the competition. Since the Eggies and Eggstractor have received many reviews that say there was still shell on the egg or that it was not as edible after the product was used, we hope to ensure a quick and easy process of removing the egg shell without affecting the taste. We also hope to require the least amount of assistance from the consumer to ensure a very effective product. Some of the disadvantages of using our product is that it will be larger in size compared to the competition. Customers might have a harder time storing our product away when it is not being used. Another disadvantage will be entering the market with two existing products already being sold that complete the same desired task as ours. When the Eggies and Eggstractor first burst onto the scene, there were little to no products that were available to the customer. This allowed them to attract the audience first; it will be difficult to sell our product to customers knowing that there are already products that exist for this specific problem.

Niche

If our product is made to perform the way we designed it, we could possibly burst onto the market like lightning out of a clear sky. Our product will be better than our competition and we will be able to steal the market away from them. Outta the Shell plans to guarantee a working device that not one of our competitors can do. The product will be made to receive no bad reviews and customers will only have positive things to say about the successfulness of our product. Since our product will allow people to complete an everyday task quickly and efficiently, the customers will have to buy our product for that value alone. Almost everyone who is tired of peeling the shell off of hard-boiled eggs will not have to worry about that anymore when our product hits the market.

Strategy

Outta the Shell plans to market our company to various businesses that might show an interest toward our product. We plan to market our company to these businesses by having personal meetings and demonstrations in front of the interested businesses. To advertise our product to a variety of businesses, we plan to contact them through phone calls and emails in order to get their attention. Outta the Shell plans to be very consistent when talking to the businesses, so when they say they will contact us in the future we might decide to be the first to contact them if we believe we are losing their interest.

Outta the Shell has identified a few ways to promote our product without exceeding the budget. We plan to have a very small company that does not include a location that will cost any money to distribute out of. The only cost for location is renting out a storage unit to store the finished products. Outta the Shell also wants to try and obtain a low cost to manufacture our product by using cheap materials that will not have an effect on the quality or effectiveness of the product. We also plan to use the school resources that are given to us in order to save money. The machine shop, computer lab, and knowledge center are a couple resources that will be useful for our company.

We will also try to use networking through the employees of our business to also get the word out about our product. Outta the Shell employees can find support from our families if they tell all their friends about our product and hope to start a chain of word or mouth about the product we have to offer. We can also try to network with different business students and professors to see if they have any tips or recommendations that could be helpful in advertising our product. Another way to network our company would be to use business cards and handing them out to everyone we come in contact with. This way there will be a way for companies to contact us, and possibly have other businesses that do not have an interest in our product exchange our cards to another business. Since we are going to sell our company once, there is no need for a strategy for repeat customers concerning our company's availability.

The main goal for Outta the Shell is to sell the company to a more successful business

and have them decide the cost of the product. However, we do want to start the company and make some sells to ensure the other businesses that there is a need for our product. Since we do not feel we are going to have to take out a lot of money for our company's location and research, the main cost will be the amount it takes to manufacture our product. We plan to create a cheap selling price that might limit us in profit, but will give us a high amount of products sold. We predict that our selling price will be a little higher than that of our competitor. This does not frighten us because our product is designed to work faster and have better quality compared to our competitors' products. The price of the Eggies is \$10.00 plus shipping and handling, while the price of the Eggstractor is \$24.99 plus shipping and handling. Our projected price will be a more than the prices of our competitor products. Since there is more material used in our product to ensure quality and speed, it will cost more to manufacture which is the reason why the final price of the product will be higher than the competition.

VI. Operational Plan

Since the Outta the Shell design team will still be in school while it tries to create its company, there will be no daily business hours. We plan to set up times throughout the week that works with every participant's schedule where we will discuss different business related tasks that need to be performed. We plan to hold these meetings at different locations on campus whether it be the knowledge center, computer lab, or an off campus location. To save money Outta the Shell will use all the resources and equipment the university has to offer. The processes we will take in completing our company will be guided by our assignments in our system design class followed by the distribution of our company to another business. The main environment that will be visited by Outta the Shell would have to be the university's campus because it is closest location where everyone can meet.

Production

Outta the Shell will be contracted and manufactured by a company in the continental US. After assembly from the manufacturer, Outta the Shell will store finished products in a local warehouse to be shipped out to customers after ordering from the website or by phone. The methods of production will be up to the manufacturer to follow guidelines for standard engineering as well as FDA approved materials based off Outta the Shell design specifications. The goal is to use cheaper yet durable materials in the design to ensure that the manufacturing price will be inexpensive thereby ensuring that the finished product will be inexpensive as well. The idea is to just take our product to the prototype level, detail the steps to make a prototype and convey that to a manufacturing company for mass production.

Location

Outta the Shell is not planning on having a lot of expenses going toward the location of our business. We plan to work out of an office at one of the owners' home and using this address to ship the product to different customers. We have decided, however, that we will need somewhere to store the product after it goes through manufacturing. To solve this problem, Outta the Shell decided the cheapest and most efficient way to store the product will be by using a storage unit from a self-storage company in Reno. The plan is to rent out the largest unit which is a 10x20 unit at the cost of \$105 per month. Since we plan on eventually selling the company, the amount of time needed after manufacturing has begun and time it takes to sell the product will not exceed eight months, this is our cheapest way to store the product because we do not have to deal with renting out an office or warehouse. We also plan to meet on campus to various times a week to discuss the progress of the company and manufacturing of the product. The only downfall is that people in Reno will not be able to just go to the company building and purchase the product there. However, we might be able to figure out a drop off system that will be able to communicate with our Reno customers that will allow them to pick up the product

at a specific time to avoid the shipping fee. Since we will not officially have a store to purchase the product, we will have no business hours to come pick up the product. We will, however, have different times of the day most likely 9am to 5pm where customers can call and ask questions or make requests regarding the product.

Cost

Since we will be using the school to meet and someone's house to work out of there will be no cost required, yet Outta the Shell will be renting out a storage unit for \$105 a month for about eight months. This will cost us around \$840. Since we will require our customers to pay for the shipping and handling fee, the only other expense will be the cost to box up our product so it is ready to be shipped. Outta the Shell will purchase these boxes in bulk for around 0.87 per box. The overall expense will depend on the amount of products shipped.

Our business will only require a Trade Secret. This will allow us protection for our product's design during the company's operation and when we sell to another company. Our product, Outta the Shell, does not call for or fit the requirements for a patent and acquiring such protection is costly. To obtain a trade secret, we will consult a patent attorney at the University of Nevada, Reno, as this will reduce our total legal costs. Later, when our product is launched, we will have an attorney ready if there are any complications with our retailers.

Each member in our partnership is certified as Engineering Interns and will hold Bachelor of Science degrees in Mechanical Engineering. Such qualifications verify our proficiency in the business as engineering designers. Our storage unit will be kept clean and organized, and our documentation will be thorough and organized as well. The company will acquire a lawyer if problems do arise. The products will, however, have a guarantee and a solid return policy.

Personnel

Outta the Shell personnel consist of six different owners of equal importance. The labor carried out by each will consist of extremely skilled design analysis computer design. The owners were grouped by personal choice to carry out the necessary objectives for Dr. Kam Leang's ME 451 design class. It is not intended to exceed the boundaries and find more employees for the future of Outta the Shell. The staff at Outta the Shell all possess Engineering Intern certification from the Nevada State Board of Professional Engineers and Land Surveyors and they are in pursuit and near completion of the Bachelor of Science in Mechanical Engineering. Outta the Shell has an intelligent and dedicated staff that strives for excellence and perfection to continuously make sacrifices and decisions to ensure better quality of the product. The pay structure for each of the owners will be determined when Outta the Shell is purchased by another company, but until that time there will be no profit involved for any of the owners.

Outta the Shells’ six owners and their tasks are very elaborate. Loretta Williams is the team leader and office manager for Outta the Shell, which means she is responsible for the productivity and success of the group as a whole. Greg Beasley, Jr., is the manufacturing correspondent, which means he will work with the manufacturer of the product and make sure everything is being produced properly and with the correct materials. Matt Hoff is the product development researcher, so he will ensure that the product uses state-of-the-art elements and methods by researching the product in search for materials or methods to make it function or look more successful. Mitchell Bellamy is the product manager, so he will be making sure the product works effectively and efficiently at all times in response to product design changes. Jeff Iddings is the marketing specialist, which means that he will be mainly researching the market and industry constantly in search for the best method of sales for Outta the Shell. Finally, Sasan Alishahi is the mechanical design specialist that mainly manages the prototype design and seeks mechanical ways to make the product better on a mechanical level. Although each owner has their own special area of expertise, we all perform our tasks concurrently and work together for every obstacle that we may encounter at Outta the Shell.

The schedule of each personnel is not defined. We expect each owner to carry out their tasks correctly and effectively in collaboration and with communication between all the other owners before making decisions for the group. It is not intended by Outta the Shell to use any sort of contract workers to establish legal agreements between the personnel to guarantee that the worker will get their work done. The level of trust is very high within this partnership, so legal action will not need to be taken notice. The schedule for the group as a whole is described in the timeline below.

Table 2: Schedule

	Timeline															
	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12 through July-13	Aug-13	Sep-13
Design/ Prototype	█	█	█	█	█	█	█	█	█	█						
Business Plan						█	█	█	█							
Operational Agreement						█	█	█	█							
Patent Application						█	█	█	█	█						
Loans									█	█	█					
Acquire Location									█	█	█					
Setup Bank Accounts									█	█	█	█				
Equipment									█	█	█	█				
Manufacturing Process										█	█	█	█			
Materials										█	█	█	█			
Networking										█	█	█	█			
Advertising										█	█	█	█			
Aquire Buyers											█	█	█	█		
Employees											█	█	█	█		
Launch Product													█	█	█	
Run Company														█	█	█
Become Known														█	█	█
Make an Impact in Market														█	█	█
Find Company to Buy Business															█	█
Transition to New Company															█	█
Disband																█

Inventory

Since the product will be manufactured by contract to a manufacturer, our inventory will only be finished goods to be shipped out to customers. Along with complete finished

goods, we will provide spare parts in the event that the customer needs to replace the blade. The blade will be made of a stainless steel, and the rest of the device will be a combination rubber, plastic and aluminum.

It is expected that initially turnover will be really slow as in today's economy, the want and a need for an egg peeler. Once word of mouth picks up, production of the product will begin to pick up, or inevitably drop off.

If an order is placed on Monday through Friday before 4pm the order can be shipped the same day; if order is placed after 4pm on Monday through Thursday, order will be shipped next business day; if order is placed after 4 pm on Friday or on the Weekend, the order will be shipped the next business day (Monday).

Suppliers

To come up with the prototype, possible suppliers of materials will be speedymetals.com for all of our aluminum, and steel materials. Also meridian-products.net to help with setting up the product for manufacturing of the prototype. They offer end-to-end manufacturing assistance, which will be of great help to the members of Outta the Shell for manufacturing of a prototype.

Credit Policies

Outta the Shell will be selling the product through off of the web page. Our system will be secure and our manufacturers and distributors will be checked for credibility and quality. If any retail company approaches Outta the Shell wishing to sell our product, we will do extensive research to assess their credit standing. Their reputation and quality assurance is of high importance. We plan to sell on credit if retailers wish to sell our product, which is standard for this type of business. There are risks with this agreement, so strict policies will be necessary. These include contract agreements and consequences for misconduct. In order to promote trust and reliability, Outta the Shell will offer discounts for retailers. For example, there will be a two percent discount if the payment due is paid within the first ten days. Otherwise, payment is due in one month.

Managing Your Accounts Payable

Outta the Shell will be working closely with a manufacturer as we will simply be storing and selling the product. The manufacturer will order and manage the materials and production of the egg peeler. So, we will be paying them for their service. With the loan from the bank, Outta the Shell will pay the manufacturer immediately so that no interest is accrued. With a year contract, loyal service, and quick payments, we hope to acquire a discount for future orders.

VII. Management and Organization

The management and organization of Outta the Shell as a company is extremely important to all of its members. Although we all plan to pull our own weight and intend to accomplish everything we embark, Loretta Williams as the team leader will be the manager of the business on a day-to-day basis. She will be responsible for overseeing and ensuring that the individual tasks are indeed complete correctly and within the required time frame. Loretta is an expert at time management and work justification. She also is very outgoing and honest with people about what they need to get done, which is both motivational and ethically effective.

Although all of the owners are very dependent on our business manager and leader, Loretta Williams, all owners are also prepared to take on more or less actions for the company at any time. If Loretta is unreachable or unavailable, the other owners will step in and take over Loretta's tasks. Loretta is very organized and has meeting plans written out for all of the owners prior to owner discussions, so things could carry on smoothly without her presence.

The owner's specific roles in the business and day-to-day tasks are previously described under the personnel portion of the operational plan (Section VI). Each owner is extremely organized with their work and will maintain that high level of organization throughout the lifetime of the product under direct order of Loretta.

Professional and Advisory Support

Outta the Shell will utilize outside support for our company's business and engineering management. Since the owners are proficient in engineering and only vaguely familiar with managing business finances, we will be consulting Robert Reed, Accountant. In regards to business advice and insurance consultation, Sean Marler, Country Insurance Agent, will be our primary support. Legal advice will be provided by the University of Nevada-Reno legal department. Outta the Shell has designed the product and its prototype and set up the business basics with the support of Dr. Kam Leang, a professor at the University of Nevada, Reno, and our key mentor. Finally, Bank of America will be our bank of choice, providing us with our initial loan and protecting our business accounts.

VIII. Personal Financial Statement

All together the owners can put together \$8,000 for back-up expenses.

IX. Startup Expenses and Capitalization

Table 3: Startup Expenses and Capitalization

SOURCES OF CAPITAL	
Owners' Investment (name and percent ownership)	
Outta the Shell	\$ 8,000
Total Investment	\$ 8,000
Bank Loans	
Bank of America	\$ 100,000
Total Bank Loans	\$ 100,000
STARTUP EXPENSES	
Location and Admin Expenses	
Rental	\$ 210
Legal and accounting fees	500
Total Location and Admin Expenses	\$ 710
Opening Inventory	
1,000 Units	\$ 15,000
Total Inventory	\$ 15,000
Advertising and Promotional Expenses	
Advertising	\$ 5,000
Total Advertising/Promotional Expenses	\$ 5,000
Other Expenses	
Legal Advice	\$ 500
Total Other Expenses	\$ 500
SUMMARY STATEMENT	
Sources of Capital	

Owners' and other investments	\$ 8,000
Bank loans	100,000
Total Source of Funds	\$ 108,000
Startup Expenses	
Location/administration expenses	710
Opening inventory	15,000
Advertising/promotional expenses	5,000
Other expenses	500
Total Startup Expenses	\$ 21,210
SECURITY AND COLLATERAL FOR LOAN PROPOSAL	
Collateral for Loans	Value
Stock	\$ 21,210
Owners	
Outta the Shell	
Loretta Williams, Team Leader	
Greg Beasley, Jr.	
Mitch Bellamy	
Matt Hoff	
Jeff Iddings	
Matt Hoff	
Sasan Alishahi	

X. Financial Plan

12-Month Profit and Loss Projection

Outta the Shell is a design engineering group, dedicated to providing a way to peel hard-boiled eggs and making a healthy lifestyle a little easier. After an analysis of our projected cash flow and profit, the company will very nearly break even. The largest source of income will be during the final month, when the business is sold to another kitchenware company.

By the end of our business plan, September 2013, we shall have made a profit of \$56,200. This does not include how much the business will be sold for, approximately \$100,000, about what the company will be worth at that time.

Table 4: Cash Flow Projection

Small Business Cash Flow Projection														
Outta the Shell														
Starting date	Sep-12													
Cash balance	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	10,000	
alert minimum	10,000	0	0	0	0	0	0	0	0	0	0	0	0	
	Beginning	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Sep-13	Total
Cash on hand (beginning of month)	100,000	100,000	90,542	83,363	78,275	77,167	74,068	70,165	66,657	63,148	59,360	56,642	54,318	
CASH RECEIPTS														
Cash sales		4,000	8,000	10,000	14,000	12,000	13,000	14,000	14,000	15,000	16,000	17,000	16,000	153,000
Returns and allowances		20	40	50	70	60	65	70	70	750	80	85	80	1,440
Owner contributions		8,000												8,000
TOTAL CASH RECEIPTS		11,980	7,960	9,950	13,930	11,940	12,935	13,930	13,930	14,250	15,920	16,915	15,920	162,440
Total cash available	100,000	111,980	98,502	93,313	92,205	89,107	87,003	84,095	80,587	77,398	75,280	73,557	70,238	
CASH PAID OUT														
Legal Advice		500	200	100	100	100	100	100	100	100	100	100	500	2,100
Interest expense		833	833	833	833	833	833	833	833	833	833	833	833	10,000
Materials and supplies (in COGS)		15,000	9,000	9,000	9,000	9,000	10,800	11,400	11,400	12,000	12,600	13,200	12,600	135,000
Rent or lease		105	105	105	105	105	105	105	105	105	105	105	105	1,260
Web Page		5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000		55,000
SUBTOTAL		21,438	15,138	15,038	15,038	15,038	16,838	17,438	17,438	18,038	18,638	19,238	14,038	203,360
TOTAL CASH PAID OUT		21,438	15,138	15,038	15,038	15,038	16,838	17,438	17,438	18,038	18,638	19,238	14,038	203,360
Cash on hand (end of month)	100,000	90,542	83,363	78,275	77,167	74,068	70,165	66,657	63,148	59,360	56,642	54,318	56,200	

The sales projects a slow but steady increase in profit in the last few months of our plan, and it is estimated that the sales will continue to grow. So, \$100,000 will be a reasonable price for the business.

Projected Cash Flow

This analysis was based on a constant monthly inventory of 1,000 units. The projected sales were estimated based off of future egg sales and health trends. It is also assumed that manufacturing fees and cost per unit will remain constant through the one year period. The expenses, such as legal advice, rent, and interest, will be paid as profit is made.

Opening Day Balance Sheet

Table 5: Opening Day Balance Sheet

OPENING DAY BALANCE SHEET

Outta the Shell

ASSETS

Current Assets

Cash in Bank	\$ 8,000
Inventory	15,000
Total Current Assets	\$ 23,000

Fixed Assets

Real Estate / Buildings	210
Total Fixed Assets	\$ 210

Other Assets

Specify	-
Total Other Assets	\$ -
Total Assets	\$ 23,210

LIABILITIES & NET WORTH

Current Liabilities

Accounts Payable	\$ -
Total Current Liabilities	\$ -

Long-term Liabilities

Bank Loans Payable (<i>greater than 12 months</i>)	\$ 833
Total Long-term Liabilities	\$ 833
Total Liabilities	\$ 833
Owners' Equity (Net Worth)	\$ 22,377
Total Liabilities & Net Worth	\$ 23,210

Break-Even Analysis

Table 6: Break Even

BREAK-EVEN ANALYSIS			
Fixed Costs		Variable Unit Costs	
<i>Costs required to produce the first unit of a product.</i>		<i>Costs that vary directly with the production of one additional unit.</i>	
Definition	Cost	Definition	Cost
Storage Unit Rent Per Month	1,260.00	Manufacturing for 1 yr., 8250 units	99,000.00
Web Page	60,000.00	Manufacturing Fees	36,000.00
Interest Expense	10,000.00		
Unit Selling Price:		20.00	
<i>The amount of money charged to the customer for each unit of a product or service.</i>			
Expected Unit Sales:		7,650	
<i>Number of units of the product projected to be sold over a specific period of time.</i>			
Break-Even Units:		-0.53	

The assumptions made for the break even analysis are the same made for the projected cash flow analysis.

XI. Supplements

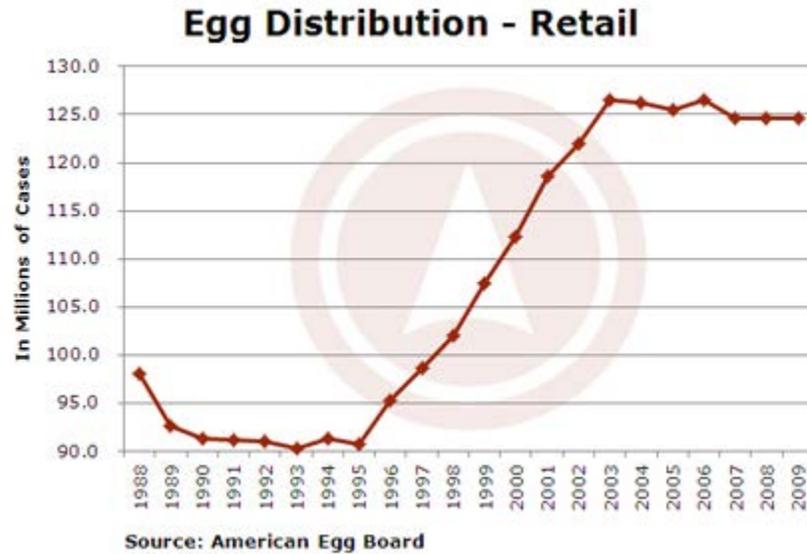


Figure 1A: The amount of eggs distributed over the years.

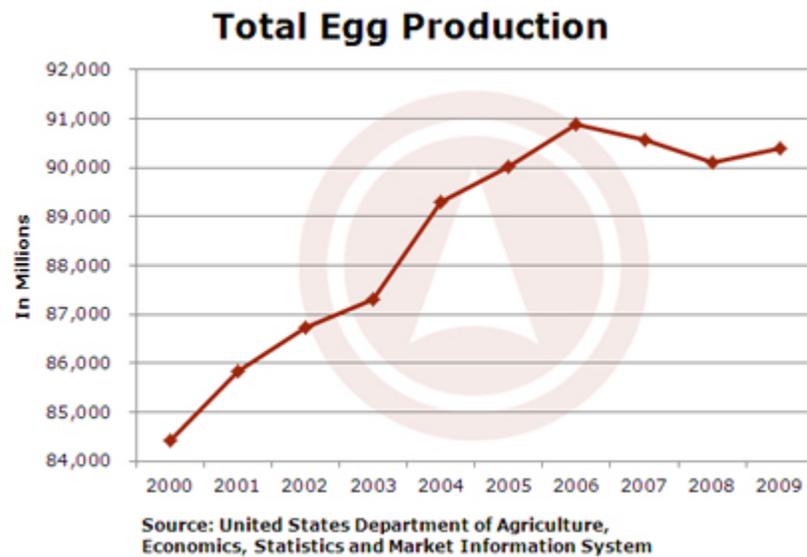


Figure 2A: The amount of eggs produced over the past decade.

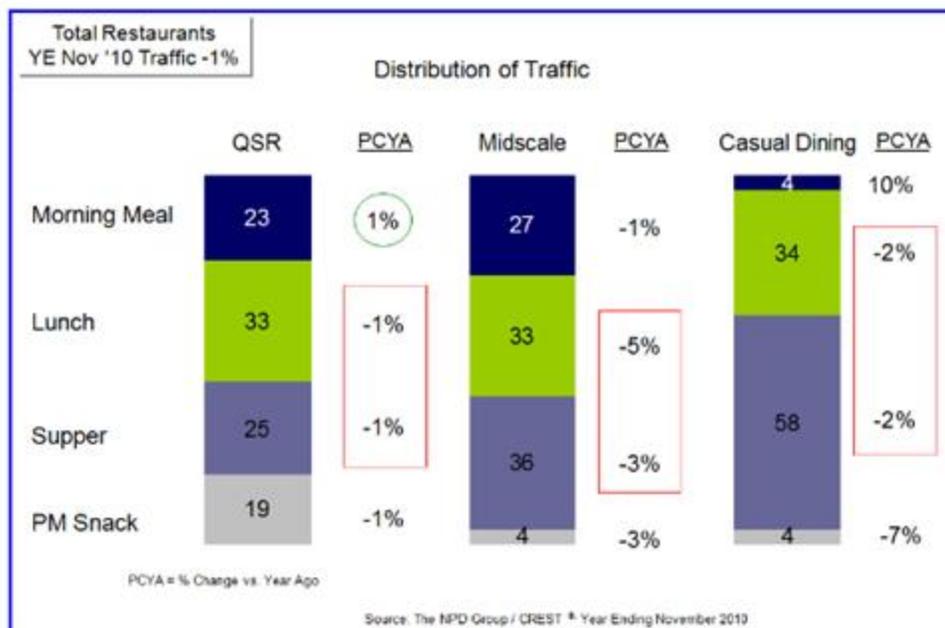


Figure 3A: Distribution of eggs to different types of restaurants throughout the day.

References

"Egg Industry." *American Egg Board*. N.p., n.d. Web. 20 Feb 2012. <www.aeb.org>.

"Eggs: Will They Crack Under Increased Pressure." *Industry Insights*. AccuVal Associates, Inc., Sept. 2010. Web. 24 Feb 2012.

<<http://www.accuval.net/insights/industryinsights/detail.php?ID=146>>>.

XII. Refining the Plan

High Technology Retail Company

Outta the Shell is dedicated to the health of the community by simplifying the process to peel hard-boiled eggs. We recognize the nutrition eggs have to offer and we believe our product will allow people to be one step closer to a healthier lifestyle.

After designing a product that peels hard-boiled eggs, Outta the Shell will set up a *starter* business and introduce the product to the community. In September of 2012, people will have the opportunity to purchase their very own egg peeler. After twelve months, Outta the Shell will sell the business to a kitchenware company, turning over the trade secret.

The hard-boiled egg peeling device will be cutting edge. It will be designed with FDA approved, light weight, cost friendly material. The methods of cutting will be designed with optimal safety; the blades will be secured and enclosed, and the device will be cleanable and user friendly. In order to promote the product, Outta the Shell will run a website. Customers will be able to review the product, email us with questions or concerns, and purchase the product.

Extensive studies have been conducted regarding the egg industry. Eggs are full of nutrition and versatile as they can be made in a multitude of ways. We have gathered the data and assessed how Outta the Shell will survive in the market. Other companies have products in stores similar to our egg peeler; however, our design will have edge. The greatest quality our product has is its reliability, which surpasses any other. Since we have an innovative design, we will obtain a trade secret.

Each week, an assessment of the egg industry will be re-established. Constant analysis is important to ensure success in the company. We will watch egg popularity, egg costs, and competitors market influence.

Outta the Shell promotes quality and health. So, we will ensure this to our customers. One way is through a return policy and guarantee. Also, we will meet with egg distributors on possibly agreeing on mutual coupon options. We can promote their eggs through a percent off discount and their egg packages could provide a percent off discount.

The company will sell each unit for \$20. The quality and reliability of the product justifies this price, as it covers materials and some profit for Outta the Shell. If the price is set too low, customers will not trust the product's quality. Too high of a price, on the other hand, will deter the customer and reduce the company's image. Also, we will have a guarantee and a return policy.

We will maintain a monthly inventory of 1,000 units, which can adjust according to popularity. It is estimated that manufacturing costs for such stock will be \$12 per unit

plus a monthly fee of \$3000.

Outta the Shell will run out of a home office and a storage unit located in Reno, NV. Reno is an excellent city for distribution as it is the hub of many warehouses and the intersection of Highway 395 and Interstate 80. A quality product can now be distributed from a quality location.